

Local Electronic Structure and MCD of $\text{La}_{1-x}\text{MnO}_3$ films

M. DeLeon, T. Tyson (NJIT), C. Dubourdieu (CNRS), D. A. Arena (NSLS)
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Introduction: Lanthanum deficient $\text{La}_{1-x}\text{MnO}_3$ films have been found to undergo antiferromagnetic-ferromagnetic transitions at temperatures up to 270K. The $\text{La}_{1-x}\text{MnO}_3$ system is especially attractive due to its chemical simplicity. T_c values have been measured to values up to 270K [1, 2, 3]. We have previously studied $\text{La}_{0.8}\text{MnO}_3$ films with varying thickness and have found a reduced magnetic saturation moment as compared to a theoretical value of about $3.6 \mu_B/\text{Mn}$, which may be explained by canting of the spins or varying magnetic structure throughout the thickness of the films.[4] Magnetic circular dichroism measurements, which are extremely surface sensitive, would compare surface magnetic moments with our previously measured value, which accounts for whole of the films. Additionally, electron yield measurements as compared to x-ray absorption measurements would explore differing electronic structure at the surface and within the films. Additionally, films with similar thickness and similar stoichiometry but different substrates may be compared.

Methods and Materials: Epitaxial $\text{La}_{1-x}\text{Mn}_{1-z}\text{O}_{3-\delta}$ films of 2000Å thickness were grown on (0 0 1) SrTiO_3 substrates via metal-organic chemical vapor deposition, with x values of 0.17, 0.10, 0.04, -0.03, and -0.09.

Epitaxial films of $\text{La}_{0.8}\text{MnO}_{3-\delta}$ films were similarly deposited on (001) LaAlO_3 with thickness of 500Å, 1000Å, and 2000Å. The x=1.03 and 1.09 films have deficiency on the Mn side. Electron yield and polarized x-ray absorption near-edge structure measurements were conducted at the oxygen K edge, Mn L-II and L-III edges and La M-IV and M-V edges. MCD measurements were conducted at the Mn L-II and L-III edges.

Results: Preliminary measurements have found great differences of the O K-edge of two thick films of similar lanthanum content but on different substrates, LaAlO_3 producing compressive strain and SrTiO_3 producing tensile strain [Figure 1]. Preliminary analysis of the MCD measurements at various temperatures support previously measured T_c 's. Polarized x-ray absorption measurements reveal subtle differences in the directions in-plane and out-of-plane.

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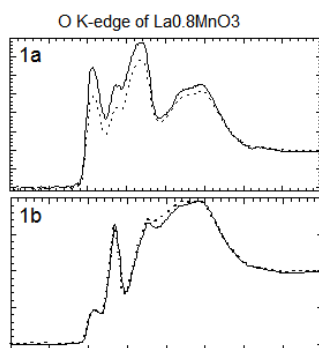


Figure1. O K edge of LMO films with x ~0.2 deposited on (1a) LaAlO_3 and (1b) SrTiO_3 which gives compressive and tensile strain at the substrate interface respectively. The dotted lines are polarized with \mathbf{E} perpendicular to the surface and the single lines have \mathbf{E} parallel to the surface.